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Iodine-deficiency prophylaxis and the restriction of salt consumption — a 21st century challenge

Profilaktyka jodowa a ograniczenie spożycia soli — wyzwanie XXI wieku

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Abstract

The World Health Organization (WHO) issued a recommendation (Technical Consultation: Paris 2006, Luxembourg 2007) that salt consumption, as a risk factor for hypertension, atherosclerosis, myocardial infarction, stroke, and select cancers, should be restricted. The European Commission looked to adhere to this recommendation by creating the High Level Group on Nutrition and Physical Activity. According to WHO
recommendations, a daily allowance of 5 g NaCl (*i.e.*, 2 g Na) for individual salt consumption should not be exceeded. At present, mean individual salt consumption in Poland totals 13.5 g, of which salt used in household constitutes 8.8 g. In some regions of Poland, this number reaches upwards of 15.0 g/person. The Position Paper on Initiatives Aimed at Decreasing Salt Consumption in Poland, developed by an expert group at the National Food and Nutrition Institute, set the course for intervention, including changing recipes for mass-produced food products and large-scale catering, improving oversight by food control agencies, and continuing legislative changes. These interventions should also include education directed towards consumers, food producers, public health professionals, healthcare workers, and media representatives. The Position Paper of the Polish Hypertension Society also sets the course for promoting restricted salt consumption and controlling hypertension on a population level. However, household salt is the main carrier of iodine in the Polish model of iodine prophylaxis. Thus, any interventions also require synchronized action with the Polish Council for Control of Iodine Deficiency Disorders. Current efforts aimed at preventing iodine-deficiency look to increase consumption of other iodine-rich products (*e.g.*, milk, mineral water) with standardized levels of iodine. Once they achieve an iodine concentration of 0.1–0.2 mg, these products can easily supplement any decrease in physiological iodine levels resulting from reduced salt consumption. Also required are wide-ranging educational campaigns which will be coordinated by the new designated WHO Collaborating Centre for Nutrition at the Chair of Endocrinology at Jagiellonian University, *Collegium Medicum* in Kraków. **(Pol J Endocrinol 2010; 61 (1): 135–140)**

Key words: *iodine prophylaxis, goitre, restriction of salt consumption, hypertension*

Streszczenie

Światowa Organizacja Zdrowia (WHO, *World Health Organization*) wystosowała rekomendacje (Techniczne Konsultacje : Paryż 2006, Luksemburg 2007) dotyczące konieczności ograniczenia spożycia soli jako czynnika ryzyka nadciśnienia tętniczego, miażdżycy, zawałów serca, udarów oraz niektórych chorób nowotworowych. Wyzwanie to podjęła Komisja Europejska i utworzona przez nią Grupa Wysokiego Szczebla ds. Żywienia i Aktywności Fizycznej. Zgodnie z zaleceniami WHO dzienne spożyci soli nie powinno przekraczać 5 gr NaCl (2 g sodu)/osobę. Średnie dzienne spożycie soli w Polsce wynosi 13,5 g/osobę, w tym 8,8 g soli kuchennej, a w niektórych regionach kraju dochodzi do 15,0 g/osobę. Opracowane przez grono ekspertów Instytutu Żywności i Żywienia „Stanowisko w sprawie podjęcia inicjatywy zmniejszenia spożycia soli w Polsce" określa kierunki działania obejmujące: zmiany receptur przetworów spożywczych w przemyśle spożywczym i placówkach żywienia zbiorowego, wzmożenie nadzoru organów urzędowej kontroli żywności, kontynuacje odpowiednich działań legislacyjnych. Dotyczą one również działań edukacyjnych, kierowanych do konsumentów, producentów żywności, pracowników ochrony zdrowia i instytucji zdrowia publicznego, oraz przedstawicieli mediów. Stanowisko Polskiego Towarzystwa Nadciśnienia Tętniczego podejmuje akcję promocji ograniczania spożycia soli i kontroli nadciśnienia tętniczego na poziomie populacyjnym. Program taki wymaga synchronizacji działań z Polską Komisją ds. Kontroli Zaburzeń z Niedoboru Jodu w zakresie niezbędnych modyfikacji systemu profilaktyki jodowej. Ograniczenie spożycia soli zmniejszy bowiem dzienną dawkę jodu. Aktualne modyfikacje systemu profilaktyki jodowej idą w kierunku zwiększenia spożycia innych nośników jodu: mleka i wód mineralnych ze sprawdzoną zawartością jodu. W obu wypadkach stężenie jodu osiąga wartość 0,1–0,2 mg jodków i nośniki te mogą uzupełnić niedobór jodu spowodowany ograniczeniem spożycia soli. Wymaga to szerokiej akcji edukacyjnej, która jest częścią programu nowopowołanego Ośrodka Współpracującego z WHO w zakresie żywienia przy Klinice Endokrynologii UJCM w Krakowie. **(Endokrynol Pol 2010; 61 (1): 135–140)**

Słowa kluczowe: *profilaktyka jodowa, wole, ograniczenie spożycia soli, nadciśnienie*

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Introduction

After considering the harmful effects of a high dietary salt concentration, the WHO Consultation of Experts held in Paris in 2006 [1] and Luxembourg in 2007 [2] recommended that daily salt consumption be limited to 5 grams NaCl, equivalent to 2 grams Na, per person. The High Level Group on Nutrition and Physical Activity was entrusted with seeing this recommendation applied in practice in Poland. Activities aimed at reducing salt consumption were listed as priorities for 2008. Salt consumption in Poland, compared to other European countries, is exceptionally high (Table I). Excessive dietary salt consumption is a risk factor for arterial hypertension, which may further lead to such negative health events as stroke, myocardial infarction, cardiac failure, osteoporosis, and certain neoplasms. Hypertension currently affects approximately nine million Poles. Complications associated with hypertension are currently the leading causes of death among those aged 60 years and over. They are also the second leading cause of death among those aged 15–59 years. In 2005, the high cost of treating these complications in the European Union was estimated at EUR 169 billion [3]. The Chair and Clinic of Endocrinology at Jagiellonian University Medical College is currently coordinating two pioneering programs aimed at reducing daily dietary salt consumption: a multi-centre Program to Eliminate Iodine Deficiency (financed by the Polish Ministry of Health) [4], and a program regulating dietary salt consumption among patients at the University Hospital in Kraków. However, any effort aimed at lowering daily dietary salt consumption in Poland should be far-reaching and enacted on a large population level. It should target, among others, food consumers and producers, healthcare and public health professionals, state-run oversight agencies, and media representatives. Such efforts need to be further coordinated with initiatives meant to ensure proper iodine consumption, as recommended by the WHO (Table II). In Poland, as in other European countries, iodine prophylaxis initiatives are centred on supplementing table salt with iodine. Such supplementation is calculated based on actual salt consumption [5]. Functioning since 1998, the Polish Commission to Prevent the Effects of Iodine Deficiency has instituted a mandatory iodine prophylaxis program based on the iodization of table salt at concentrations totalling 30 ± 10 mg KJ/kg [6]. This program was found to be exceptionally effective; in just a few years endemic goiter among school-aged children was completely eliminated [7].

As a result, restricting daily dietary salt consumption requires that iodine prophylaxis interventions be additionally modified. It is further essential that both programs be conducted in tandem. In response to this new challenge, WHO Consultation of Experts held in Luxembourg in 2007 [2] laid the groundwork for modifying iodine prophylaxis programs worldwide. In Poland, synchronizing these two initiatives is the responsibility of the Program to Eliminate Iodine Deficiency as well as the National Food and Nutrition Institute. The work of these two bodies is based on the *Position Paper on Initiatives Aimed at Decreasing Dietary Salt Consumption in Poland*, drafted by a panel of national experts [8]. Recently, the WHO Collaborating Centre at the Clinic of Endocrinology at Jagiellonian University Medical College has also assumed an important role in synchronizing these two initiatives. The program of the WHO Collaborating Centre includes, among others, promoting reduced dietary salt consumption and modifying the iodine prophylaxis program.

Table I. *Daily individual salt consumption in selected European countries (g/day) [1]*

Tabela I. *Dzienne indywidualne spożycie soli w wybranych krajach Europy (g/dzień) [1]*

Denmark	8.2–8.4
France	7.9–8.4
Belgium	8.3–8.7
Germany	8.2–8.8
Portugal	9.0–11.5
United Kingdom	9.7–11.7
Italy	9.2–10.8
Poland	13.5 g (including 8.8 g table salt) [25]

Sources: WHO 2003, Szponar et al., National Food and Nutrition Institute 2008

Table II. *Recommended daily dietary iodine consumption (mg/person/day) [32]*

Tabela II. *Rekomendowane dzienne spożycie jodu (mg/osobę/dzień) [32]*

Preschool-aged children	0–59 months 90
Elementary school — aged	6-12 years 120
Adolescents and adults	> 12 years 150
Women, pregnant and nursing	250

Sources: WHO, UNICEF, ICCIDD-22

Sodium — a major risk factor for arterial hypertension

Arterial hypertension, found in more than 30% of adult Poles, is a fundamental risk factor for a variety of car-

diovascular diseases. A further 30% of adult Poles have normal–high blood pressure, which has also been found to increase the risk of cardiovascular disease [9–11]. The relationship between sodium consumption and hypertension has been extensively documented in a variety of empirical, observational, and intervention studies [12–14]. The INTERSALT study [15], which covered a sample population of ten thousand participants, found that high sodium consumption was directly related to higher blood pressure values, which further increased with age. The DASH-Sodium study found that reduced sodium consumption, as part of a low-sodium diet, effectively decreased blood pressure. This ultimately led to the development of the "DASH Healthy Diet": a diet rich in vegetables, fruits, grains, and fibre, while being limited in red meat, fats, and desserts. At present, mean table salt consumption per capita is very high in Poland, estimated at 15 grams per day. Compared to other countries participating in the European Project on Genes in Hypertension (EPOGH), the population of Kraków was found to have the highest level of sodium consumption in Poland [11]. Reducing dietary sodium is one of the main lifestyle recommendations in the treatment of hypertension. The European Society of Hypertension recommends that patients with hypertension consume no more than 5 grams of salt daily, equivalent to 2.0 grams (90 mmol) sodium [15]. Carrying this recommendation over to the general population may also be worthwhile, possibly leading to an improvement in public health and playing a significant role in the primary prevention of hypertension and other cardiovascular diseases.

For several years, Prof. G. MacGregor of the Blood Pressure Unit at St. George's University in London (United Kingdom) has been conducting the Consensus Action on Salt and Health (CASH). One of the successes of this program is a noticeable drop in table salt consumption in the United Kingdom. The principles of the CASH initiative were subsequently applied in the World Action on Salt and Health (WASH), of which the Polish Hypertension Society is a member. WASH recommends including reduced-sodium products in one's diet [16].

Reducing salt consumption in Poland in relation to efforts by the European commission and the WHO

Excessive salt consumption is a risk factor for arterial hypertension, including its potential complications (*e.g.*, stroke, myocardial infarction, cardiac failure), as well as such noninfectious chronic diseases as atherosclerosis, osteoporosis, and certain neoplasms. These constitute the leading causes of death among those aged 60 years and over as well as the second leading causes of death among those aged 15–59 years. The cost of treating these patients, especially those with cardiovascular diseases, is very high. The development of these health complications is significantly related to the consumption of table salt, which in some countries is very large. Table salt consumption in Poland currently exceeds WHO recommendations (*i.e.* 5 grams salt/day) by three-fold. In other European countries it is considerably lower (Table I).

In light of these alarming facts, WHO and EU took the initiative to reduce mean salt consumption. WHO recommends developing and incorporating a national strategy for reducing dietary salt consumption which reflects, among others, such cultural factors as traditional cooking habits, main sources of dietary salt, and population age groups [1].

During the first meeting of the European Commission's High Level Group (HLG) on Nutrition and Physical Activity, held in November 2007, certain countries proposed initiatives aimed at reducing the salt concentration of certain consumer products. In accordance with the European Commission's White Paper, the aim of these initiatives is to reduce dietary salt consumption at a population level. The results are set to be delivered to the European Commission.

Poland, considering its high levels of salt consumption and high frequency of health complications arising out of excessive salt consumption, supported these initiatives by joining this campaign. This lead to the drafting of the *Position Paper on Initiatives Aimed at Decreasing Dietary Salt Consumption in Poland* [8], which was widely discussed in the general public as well as among healthcare professionals, the Chief Sanitary Inspector, scientists and researchers, and food producers. This document, in supporting the HLG, found that efforts aimed at reducing salt consumption in Poland should:

— be in agreement with European Commission guidelines and constitute part of the National Program to Prevent Obesity and Non-Infectious Chronic Diseases Through Improving Dietary Habits and Physical Fitness (POL-HEALTH);
— include simultaneous campaigns meant to educate consumers, food producers, public health and healthcare professionals, national consumer oversight bodies, and representatives of the media on how to reduce the use of salt in one's diet and recommend low-sodium consumer products;
— expand dietetic counselling vital to any preventative endeavours and the treatment of non-infectious chronic diseases caused by, among others, excessive salt consumption;
— cooperate with food producers and gastronomic providers to encourage a gradual change in the recipes (*i.e.* reflective of decreased salt usage) of mass-pro-

duced and other food products considered to be the main sources of dietary sodium;
— reduce the amount of sodium in meals served by educational institutions and other gastronomic providers;
— incorporate healthy eating guidelines into school-based education, with emphasis on reducing salt consumption;
— expand the mandate of national consumer oversight bodies to include quality control of food products, with emphasis on reducing salt consumption;
— continuing legislative efforts aimed at reducing salt consumption.

It is thought that putting these guidelines — drafted in accordance with European Commission recommendations — into practice will significantly decrease dietary salt consumption in Poland within a period of four years. In 2009, Poland will prepare a report detailing what progress has been made in this regard.

Modifying Poland's iodine prophylaxis program in response to efforts aimed at reducing salt consumption

When Poland's iodine prophylaxis program came to an end in 1980, a team of paediatricians at the then Academy of Medicine (presently Jagiellonian University Medical College) in Kraków noticed an increase in goiter among newborns [17]. In 1987, Poland's Ministry of Health established a program headed by J. Nauman to examine the effects of the Chernobyl disaster [18], which confirmed a high frequency of adult goiter. An epidemiological study headed by Z. Szybiński in 1992–1993 [19] additionally confirmed a high frequency of goiter among school-aged children. Following an intervention by the Polish Endocrinology Association, the iodization of table salt was reinstated; however, this program was not initially mandatory. Iodine deficiency places entire populations at risk of serious health complications. The synthesis of 4-iodothyronine and thyroxine, hormones which regulate digestive processes and play a decisive role in central nervous system (CNS) development, require a daily dose of dietary iodine. Furthermore, iodine is one of the strongest known antioxidants and acts as a protective mechanism in some inflammatory and neoplastic processes. Serious iodine deficiency in pregnancy may lead to major CNS malformations in the foetus, as well as cretinism. Such cases, observed in Poland between the World Wars, were completely eliminated through iodine prophylaxis interventions. However, even moderate iodine deficiency may lead to negative health effects such as depressed higher CNS functioning, learning difficulties, problems with memory and/or cognition, and a significant decrease in IQ (*i.e.* the summary measure of these functions). Iodine deficiency generally leads to an increase in thyroid size and a greater frequency of different thyroid diseases, including cancer, and increases the risk of gastric cancer. [20, 22, 23].

In 1991, in cooperation with Poland's Ministry of Health, the Executive Board of the Polish Endocrinology Association convened the Polish Council for Control of Iodine Deficiency Disorders, headed by Prof. dr hab. n. med. Z. Szybiński and located at the Chair and Clinic of Endocrinology at Jagiellonian University in Kraków (Poland). The Council, modelled on similar bodies established in various European countries, is made up of expert endocrists as well as experts in food policy and the iodization of salt and animal feed.

In light of certain studies which confirmed endemic levels of goiter in Poland, at the request of the Council, Poland's Minister of Health issued an ordinance in 1996 mandating the universal iodization of table salt at levels totalling 30 ± 10 mg KI/1 kg salt. The Council further standardized other aspects of Poland's iodine prophylaxis model to include the iodization of baby formula for non-breastfed infants and iodine supplementation (0.10–0.15 mg) for women who are pregnant or breast feeding [24, 25]. Initiatives undertaken by the Council and coordinated by the Clinic of Endocrinology at the University Hospital of Jagiellonian University Medical College in Kraków (Poland) lead to a dramatic decrease in the frequency of iodine deficiency along with its associated negative side effects. Among children aged 6–8 years, the frequency of goiter fell to below 5% (*i.e.*, below endemic levels) [7]. In addition, a decreased frequency of sub-clinical hypothyroidism was noted among newborns [26, 27]. Such progress led a conference of WHO experts, as well as the International Commission for Preventing Iodine Deficiency, to reclassify Poland as a country with sufficient iodine consumption at a national level [28]. Effective iodine prophylaxis programs also lead to a decrease in the frequency of medullary thyroid cancer as well as its more malignant counterpart, follicular thyroid cancer [22]. Decreases in the frequency of gastric cancer have also been documented as a benefit of effective iodine prophylaxis programs, explained by the protective, antioxidant effect of iodine and by the fact that it accumulates in gastric mucosa in distal parts of the stomach [23].

WHO recommendations from Paris (2006) and Luxembourg (2007) instituted the need to restrict dietary salt consumption, mindful of its role in such diseases as hypertension and atherosclerosis, to 5 g/day, amounting to approximately 50% of the current mean consumption. A variety of consumer products serves to play a potentially important role in making up for probable decreases in dietary iodine consumption. Among others,

Table III. *Brands of mineral water with standardized levels of iodine (0.1–0.2 mg/L)*

Tabela III. *Wykaz wód mineralnych o znanym stężeniu jodu (0,1–0,2 mg/l)*

Wysowianka	Piwniczanka
Kujawianka	Szczawniczanka
Muszynianka	Celestynka

Table IV. *Iodine concentration in cow's milk [ug/L]*

Tabela IV. *Stężenie jodu w mleku krowim [ug/l]*

1970	20–40
2008	86.6–142.6 [29]

this includes different types of mineral water containing standardized concentrations of iodine (0.10–0.20 mg/L) (Table III). In cooperation with the National Research Institute of Animal Production, a study was conducted in 2007–2008 examining iodization of bovine salt licks [29]. This study found that the iodine concentration in milk from such cows increased from 30 to 120 ± 10 μg/L (Table IV), a level comparable to that of other EU countries which use animal feed supplemented with different nutrients. These two potential sources of iodine (*e.g.* mineral water and milk) should ideally be included as part of a balanced diet. Arguably, drinking one glass of milk per day may be especially beneficial to children and pregnant women.

Ensuring iodine supplementation at levels totalling 0.10–0.15 mg/day, as recommended by the WHO [30], in pregnant and breast feeding women constitutes a unique public health challenge. At present, studies at the Institute for Mother and Child in Warsaw (Poland) and the Medical University in Łódź (Poland) have found that only approximately 50% of pregnant women receive supplemental doses of iodine [31]. In this regard, general practitioners and obstetricians-gynaecologists play a key role in making sure that pregnant women receive this supplementary dose of iodine, usually in tablet form, most often combined with other minerals and vitamins.

Instituting such changes requires continuous monitoring of Poland's iodine prophylaxis program at a national level. This monitoring is currently managed by the Program to Eliminate Iodine Deficiency, financed by Poland's Ministry of Health, which monitors TSH levels in newborns, a very sensitive indicator of progress in terms of iodine prophylaxis, through routine screening. *ThyroMobile Action* is a health promotion program aimed at measuring urine iodine concentration and thyroid size in school-aged children and pregnant women and, in cooperation with the National Food and Nutrition Institute, urine sodium and iodine concentrations in adults. It also acts as a histopathological register of thyroid cancer cases. Poland's iodine prophylaxis model also plays a role in protecting the population against excess thyroid build-up of isotope 131-I in case of a disaster similar to that seen in Chernobyl.

Summary

1. The WHO recommends reducing daily table salt (NaCl) consumption to 5.0 g/day. This amount is generally considered safe, without heightening the risk for hypertension and its resultant negative health effects (*e.g.* atherosclerosis, myocardial infarction, stroke).
2. As part of the National Program to Prevent Obesity and in line with European Commission recommendations to decrease salt consumption highlighted in the *Position Paper on Initiatives Aimed at Decreasing Salt Consumption in Poland*, developed by the National Food and Nutrition Institute, efforts should be undertaken to educate consumers, food producers, healthcare professionals, and media representatives about work done to gradually change recipes used in the food industry and catering centres as well as making lessons in healthy dietary habits an essential part of mandatory education. Putting these recommendations into practice should significantly reduce mean dietary salt consumption in Poland within four years. In 2009, Poland will prepare a report highlighting what progress has been made in these areas.
3. Efforts should be aimed at reducing dietary salt consumption should be coordinated with iodine prophylaxis programs aimed at introducing food products supplemented with iodine, such as milk and mineral water.
4. Mandatory oversight of reduced salt consumption programs and iodine prophylaxis programs by state-run quality control bodies should be carried out.
5. The Program to Eliminate Iodine Deficiency should be continued, ensuring that Poland's iodine prophylaxis program remains effective.
6. Legislative efforts should be continued aimed at supporting the reduced consumption of table salt in cooperation with the WHO, and the European Commission.

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